The Emergence of "Emergence" in the Work of F.A. Hayek: An Historical Analysis

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Abstract

This paper identifies the sources on which Friedrich Hayek drew in order to develop his understanding of the notion of emergence. It is widely acknowledged that the notion of emergence plays a significant role in Hayek's analyses of both the mind and the market. On Hayek's account, the key capacities of the human mind—such as its capacity to enable people to perceive the world around them and to form plans about how to act—are emergent properties of the structured array of neurons found in the human brain. Analogously, Hayek's analysis of the market portrays the coordinative powers of the price mechanism as an emergent property of the social system that is formed when people's (inter)actions are governed by a set of norms that includes both the formal rules of property, tort and contract law, and also informal norms of honesty and promise-keeping. However, while several scholars have identified the importance of the notion of 'emergence' in Hayek's thought, none have explored systematically and in detail the sources from which he acquired his knowledge of that concept. This paper remedies that omission by examining the history of Hayek's use of the concept of emergence and identifying the sources through which notions of 'emergence' and 'emergent properties' entered his thinking. It is argued that the three main sources of influence are as follows: the ideas of the German psychologist Wilhelm Wundt; the work of members of the gestalt school of psychology; and the writings of the organicist biologists Joseph Woodger and Ludwig von Bertalanffy. The significance of the paper's findings for those interested in the development of Hayek's economics is also discussed.

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1. INTRODUCTION[1]

This paper identifies the sources on which Friedrich Hayek drew in order to develop his understanding of the notion of emergence. It is widely acknowledged that the notion of emergence plays a significant role in Hayek's analyses of both the mind and the market. On Hayek's account, the key capacities of the human mind—such as its capacity to enable people to perceive the world around them and to form plans about how to act—are emergent properties of the structured array of neurons found in the human brain. Analogously, Hayek's analysis of the market portrays the coordinative powers of the price mechanism as an emergent property of the social system that is formed when people's (inter)actions are governed by a set of norms that includes both the formal rules of property, tort and contract law, and also informal norms of honesty and promise-keeping. However, while several scholars have identified the importance of

[1] I am indebted to Bruce Caldwell for comments on an early version of the paper and also for providing access to unpublished material from the Hayek archives. The early stages of the research for this paper were carried out in the Easter Term of 2013, whilst the author was a Visiting Fellow of Peterhouse, Cambridge. I am very grateful to the Master and Fellows of Peterhouse for their support and hospitality. In writing subsequent versions of the paper, I have benefited from very helpful comments made by Joaquín Fuster, Kevin Hoover, Steve Horwitz, Roger Koppl, Jochen Runde, Virgil Storr, Janek Wasserman, and two anonymous referees. Audiences at the History of Economics Society Annual Conference (Montreal, June 2014), the Southern Economic Association (Atlanta, November 2014), the Cambridge Realist Workshop (February 2015), and the second *Cosmos and Taxis* conference (Rochester NY, May 2015), also provided helpful feedback. However, none of the above should be held responsible for any errors and infelicities remaining in the paper.

the notion of 'emergence' in Hayek's thought, none have explored systematically and in detail the sources from which he acquired his knowledge of that concept.[2]

The current paper promises to fill that lacuna by explaining how Hayek acquired his knowledge of emergence, identifying the thinkers through whom Hayek became acquainted with the concept and whose work helped to shape his understanding and use of it. In doing so, the paper focuses in particular on how the concept of emergence was incorporated into Hayek's theoretical psychology. The reason is that it is in Hayek's theoretical psychology that the notion of emergence first appeared in his work. And it is in the influences that shaped Hayek's work on the mind, therefore, that one must seek the sources from which he first learned about emergence. However, as we shall also see, an understanding of the sources from which the notion of emergence entered Hayek's psychology can also shed light on the development of his economics.

There are at three significant reasons why the story told below, although focusing primarily on Hayek's theoretical psychology, should nevertheless be of interest to historians of Hayek's economics. The first concerns the justification Hayek offers for his preferred, subjectivist methodology of economics. At least part of the reason why Hayek returned in the 1940s to his initial student essay on theoretical psychology and began to revise it into the book that ultimately became *The Sensory Order* (Hayek 1952) is that he was seeking a justification for his preferred, subjectivist approach to economics (Caldwell 1994). At the heart of that approach lay Hayek's subjectivist belief that the economy could only be understood if the beliefs and plans of the people who populate it are taken into account. But at the time Hayek was writing, such subjectivist approaches were under assault both from within economics, where the challenge

[2] See, for example, Chaumont-Chancelier (1999), Vaughn (1999), Caldwell (2004a: 309), Gaus (2006), McQuade and Butos (2005), Butos and Koppl (2007), Rosser (2010), Fuster (2011: 5), and Lewis (2012, 2015a).

came from revealed preference theory, and also from outside the discipline, where the critics included advocates of behaviourist psychology and physicalist approaches to the philosophy of mind. Viewed against this background, the idea that the mind is best viewed as an emergent property of the structured interaction of neurons in the human brain is significant for Hayek's economics because, as we shall see, it suggests that mental phenomena, such as beliefs and plans, are irreducible to physical interactions taking place in the human brain and so cannot be eliminated from explanations of people's actions without significant loss of cognitive content. An appreciation of the notion of emergence suggests, then, that there is in Hayek's work the basis for an additional argument in favour of subjectivism, based on the notion of emergence, that complements the more prominent computational arguments upon which Hayek principally relies.

Second, and relatedly, an appreciation of the sources from which Hayek drew his notion of emergence will, as we shall see, help to cast fresh light on a debate over the development of Hayek's economics and, more specifically, the model of man it presupposes, after World War Two (Caldwell 2004a, Mirowski 2007). Two important aspects of the debate concern (i) whether Hayek portrays people as a-social atoms or social beings whose attributes are shaped by the institutional context they inhabit, and (ii) the extent to which Hayek's embrace of evolutionary economics from the 1960s onwards represents a natural continuation of, or a rupture with, his earlier postwar interest in the economy as a complex system. It will be argued below that an appreciation of the significance of one of the sources from which Hayek acquired his knowledge of emergence, namely the organicist biologists Ludwig von Bertalanffy and Joseph Woodger, indicates both that Hayek was more inclined to portray people as social beings, and also that

there was more continuity in Hayek's thought between the two phases described above, than one of the participants in the debate suggests.

Third, and again relatedly, the story recounted below is significant for those interested in the development of Hayek's economics because of the light it sheds on the sources from which Hayek derived a set of concepts, including 'emergence', that he ultimately used to develop and articulate his ideas about the economy. From the early 1960s onwards, Hayek began explicitly to portray the coordinative power of the price mechanism as an emergent property of the economic system that obtains when people's behaviour is governed by a particular set of formal and informal rules. While the claim cannot be established in detail in this essay—doing so would turn an already lengthy paper into an unacceptably long one—it can be argued that, having become acquainted with ideas about emergence, and related notions such as 'levels of organisation' and 'system', through his work in theoretical psychology, Hayek subsequently redeployed those concepts, applying them not to the human mind but to the economy, in order to develop and articulate his view of the market as a complex system. (Lewis 2015b).[3] If one is to understand fully the development of Hayek's economics, in particular his view of the economy as a complex system, one needs to be acquainted with the story of how one of the key aspects of that vision, namely emergence, entered into his thought.

The structure of the paper is as follows. Section 2 carries out essential preliminary work by explaining what is meant by the terms 'emergence' and 'emergent properties', and outlining their significance for Hayek's analysis of the working of the mind. Sections 3-5 examine the influence exerted on the development of Hayek's thought by a particular thinker or school of

[3] Hayek himself recognised that his work on the mind constituted a vehicle through which new concepts were transferred into his economics, writing in the Epilogue to the third volume of *Law, Legislation and Liberty* that: 'My colleagues in the social sciences find my study on *The Sensory Order* uninteresting or indigestible … But the work on it helped me greatly to clear my mind on much that is very relevant to social theory. My conception of evolution, of a spontaneous order and of the methods and limits of our endeavours to explain complex phenomena have been formed largely in the course of work on that book' (Hayek 1979: 199-200, n. 26).

thought, focusing on how Hayek's reading of the works in question led to the notion of emergence playing an increasingly significant role in his theoretical psychology. The three sources of influence are: the ideas of the German psychologist Wilhelm Wundt (whose impact on Hayek's theoretical psychology is considered in section 3); the work of members of the gestalt school of psychologist (section 4); and the writings of the organicist biologists Joseph Woodger and Ludwig von Bertalanffy (section 5). It was principally through Hayek's reading of the work of these thinkers, in all of whose writings emergence played a significant role, that Hayek became acquainted with the concept. And it was through his attempts to incorporate their ideas into his own theoretical scheme that Hayek's account of the mind also came to rely, in an increasingly sophisticated fashion, on the notion of emergence. As Section 6 explains, the account to which this line of interpretation gives rise helps to show that certain interpretations of the nature and significance of Hayek's theoretical psychology, according to which Hayek's account is inconsistent either internally or with Hayek's subjectivist social theory, are mistaken. Thus, the current paper serves not only to identify the sources of a concept that is central to Hayek's account of the mind, but also to correct some common misconceptions about the nature and consistency of Hayek's thought.

2. EMERGENCE, EMERGENT PROPERTIES, AND SYSTEMS IN HAYEK'S SENSORY ORDER

2.1 Emergence

The term *emergence* denotes the possibility that, when certain elements or parts stand in particular relations to one another, the whole that is formed has properties that are not possessed

by its constituent elements taken in isolation. The properties in question are known as *emergent properties*, while the whole that possesses them is known as an *emergent* or 'higher-level' entity. Put slightly differently, an emergent entity is a *system* in the sense that it is comprised of a set or 'complex' of elements which are organised or related to one another in a particular way and which—when so related—exhibits properties that are different from those displayed by the elements taken in isolation. The set of relations in question is the system's *structure*. Emergent properties are structural or relational in the sense that their existence depends not only on the presence of their ('lower-level') constituent parts but also on those parts being organised into a particular structure that involves them standing in specific relations to one another. The classic example of emergence is provided by the case of water, many of whose properties—being liquid at room temperature, for instance, or being able to extinguish fires and quench a person's thirst—are quite different from the properties of the individual atoms of which water is composed. It is only when a collection of hydrogen and oxygen atoms is organised into the specific form of water molecules that the aforementioned properties obtain (Elder-Vass 2007: 28; Lawson 2012: 348-49; cf. Bertalanffy 1969: 54-55, 66-68).

The notion of emergence suggests that reality is stratified in the sense that there is a hierarchical structure of ontologically distinct levels—'a hierarchy of organised wholes', as Bertalanffy (1967: xxii) describes it—each of which has its own distinctive and irreducible properties. These include: the physical (encompassing both elementary particles and atoms); the chemical (including molecules and other compounds); the biological (embracing cellular phenomena and organisms); the mental (psychological); the individual; and the social. The existence of entities in the higher strata always depends upon their constituent and lower-level components, but the higher level entities possess emergent properties that arise only as a result of

the relations that obtain between lower-level parts and which are qualitatively novel in the sense of being irreducible to the properties of those lower-level entities taken in isolation (Bertalanffy 1969).

Emergent properties arising at one level of reality are ontologically and causally irreducible to their lower-level counterparts, and so cannot be eliminated from causal explanations that involve such powers. The reason is that the existence of such properties depends not only on the presence of their lower-level constituent parts, but also upon their being related to one another in the appropriate way. If the parts are not so related, then the property that derives from their being so will not obtain. It must, therefore, be an irreducible property of the relationally organised whole, not of the individual parts taken either in isolation or as an unstructured aggregate. The capacity to extinguish fires and to slake one's thirst is a property of water, not of the individual atoms of which it is composed. It follows, therefore, that causal explanations of how fires can be extinguished or thirst quenched have to make reference, if only implicitly, to that emergent entity, because it only when hydrogen and oxygen atoms are arranged into the form of water that the relevant causal power is present (Elder-Vass 2007: 30-3; Lawson 2012: 350-53; Bertalanffy 1969).

2.2 Emergence in Hayek's *Sensory Order*

We consider first how the account of emergence outlined above resonates with Hayek's analysis of human cognition, as presented in his book *The Sensory Order* (Hayek 1952). The task Hayek sets himself in that work is to explain why the phenomenal (subjective, mental) picture of the world provided by our senses differs from the physical order revealed to us by the natural sciences. The starting point for Hayek's analysis is the fact that there is no simple, one-to-one

correspondence between the order of our sense experiences, in which events are classified according to their sensory qualities (colour, sound, etc.), and the physical or scientific order, in which events are classified according to their relations with other events. Objects that resemble each other in sensory terms may display very different physical relations to each other, while objects that appear to be altogether different to us may display very similar physical properties. Hayek is distinguishing here between two different orders: a physical order, which is revealed to us by the natural sciences; and a phenomenal, or mental, or sensory, order which we experience as individuals. The task of theoretical psychology, as Hayek understands it, is to show how the neurons of which the human central nervous system is composed form a classificatory structure that is capable of discriminating between different physical stimuli so as to give rise to the sensory order that we actually experience (Hayek 1952: 2-8, 13-19, 37-40).

For Hayek, the human central nervous system consists of a hierarchical network of interconnected nerve fibres. Each neuron is connected to many—but not all—others by means of linkages known as axons, so that the nervous system has structure in which the position of any one neuron is defined by its connections to other nerve fibres. Neurons can generate outgoing electrical impulses (or 'firings') if they are stimulated sufficiently by incoming impulses, and it is through the transmission of such impulses that connected neurons interact with each another (Hayek 1952: 42, 55-64). On Hayek's account, it is the structure of the connections between nerve fibres that governs people's cognitive processes and which accounts for the key features of our mental experiences (Hayek 1952: 12). The (primary) nerve impulse generated by a particular external stimulus will in turn stimulate neurons connected to those along which that primary impulse is transmitted. In this way, the external stimulus leads to the generation within the central nervous system of an induced pattern of (secondary) nerve impulses, characteristic not

only of the external stimulus currently being experienced but also of the other external stimuli that have typically accompanied it in the past. Hayek refers to this train or wake of (secondary) impulses as the *following* of the initial nerve impulse.

The notion of a 'following' is significant because it is by classifying external events according to the extended pattern of nerve firings or followings they trigger that the central nervous system differentiates them from each other and thereby creates distinct sensory data. Two external events are classified as the same, and are experienced as having the same sensory qualities, if they stimulate the same configuration of neurons and so trigger an identical following. In this way, according to Hayek, the set of connections between neurons creates the classification of external stimuli that gives rise to the sensory or phenomenal order. Indeed, according to Hayek, the *neural* order—that is, the set of connections between nerve fibres in the brain, and the impulses proceeding in them—that is produced in this way *just is* the sensory order of phenomenal experience (Hayek 1952: 48-54, 62-78).

For Hayek, then, the human mind is a vast network of interconnected neurons that acts as an instrument of classification, discriminating between incoming stimuli and thereby creating the sensory qualities we experience (Hayek 1952: 16, 35). 'What we call "mind",' Hayek (1952: 16) writes, 'is thus a particular order of a set of events taking place in some organism and in some manner related to but not identical with the physical order of events in the environment.' Significantly, as Hayek's description of the mind as an 'order' suggests, Hayek conceptualizes the mind as *relational* in nature; the capacity to discriminate between stimuli, and in that way to classify them and to generate the sensory order, is a property that is possessed, not by the individual neurons taken in isolation, nor by an unstructured group thereof, but only by the structured entity that is formed when the nerve fibres are arranged as an ordered hierarchy

(Hayek 1952: 35, 46-47). It is the structure of the connections between nerve fibres that governs people's cognitive processes and accounts for the key features of our sensory experiences. As Hayek puts it, 'The connections between the psychological elements are thus the primary phenomenon which creates the mental phenomena ... the whole set of [the sensory qualities evoked by a particular external event] is determined by the *system of connections* by which the impulses [produced by that stimulus] can be transmitted from neuron to neuron ... it is thus the position of the individual impulse or group of impulses *in the whole system of such connections* which gives them its distinctive quality' (Hayek 1952: 53, emphasis added).

The significance of all this for the main topic of this paper stems from the fact that, if the power to discriminate between and classify events arises only when nerve fibres are arranged in a particular way, with particular connections or relations obtaining between them, then that capacity is an emergent property of the structured arrangement of neurons found in the human brain and central nervous system. On Hayek's account the key to explaining how the phenomenal world of our senses is produced lies in viewing the 'mind' as a *relational* order in which it not the existence of nerve fibres *per se*, but rather the fact that they are arranged in a particular way that produces the phenomenal world of our senses. Were it not the case that people's nerve fibres were arranged in such a way that some stimuli gave rise to different 'followings', then no discrimination between stimuli, no classification and, therefore, no perception would be possible. In Hayek's words, 'The mental properties [of neural events] are those which they possess only as part of the particular structure ... we call mind' (1952: 47).

On this view, while various aspects of human decision-making would not exist in the absence of neuronal firings, consciousness, expectations-formation and choice are nevertheless irreducible, both (i) ontologically and (ii) explanatorily, to neural activity. The emergent

properties are ontologically and causally irreducible to the (properties of) individual nerve fibres because they possessed only by a particular whole—namely the hierarchically ordered arrangement of neurons found in the human brain—and not by those neurons taken either in isolation or as an unstructured aggregate or group (Hayek [1964] 1967: 26). And the emergent whole—the neurons *plus* the relations that obtain between them—is explanatorily irreducible in the sense that it cannot be eliminated without loss of understanding from causal explanations of the generation of the sensory order—and other human action—because, if the nerve fibres were not related in such a way that at least some stimuli give rise to different followings, then it would be impossible to discriminate between and classify different stimuli in the way required to produce distinctive sensory qualities, etc.. On this account, therefore, the unique causal powers of human mind—including its capacity to imbue events with meaning and to initiate courses of actions in a purposeful fashion, as well as its ability to generate the phenomenal world of sense experience—all follow from the fact that the neurons of which it is composed would not behave in the ways characteristic of the human mind if they were not constituted into such a mind by a particular type of physiological/neural relationships. As Hayek puts it, even if we could identify in complete detail the physical mechanisms underpinning some classificatory process, 'We should still have to use the old [mental] categories, though we should be able to explain their formation and though we should know the physical "facts" behind them' (1952: 87). It follows, therefore, that the human mind, and associated mental properties such as purposes, beliefs, and so on, cannot be eliminated from our causal explanations of human behaviour, thereby supporting a subjectivist approach to economic methodology according to which references to

people's purposes and plans cannot be eliminated without loss of cognitive content from explanations of economic events.[4]

3. INFLUENCES ON HAYEK'S USE OF EMERGENCE PART I: WILHELM WUNDT AND HAYEK'S *BEITRAGE*

We move on now to consider the source of Hayek's acquaintance with the notion of emergence. It will be argued that Hayek's reliance on emergence developed in three main stages. The first stage, which is explored in this section of the paper, involves the early influences on Hayek's thinking about the mind, as found in his 1920 student paper on theoretical psychology, and focuses in particular on the significance of the German psychologist Wilhelm Wundt (Hayek 1920).

3.1 The *Beitrege*

Hayek spent much of his time as a student in Vienna during the period 1918-21 studying psychology, as well as economics and law (Hayek [1967a] 1992: 173). He visited Zurich during the winter of 1919-20, spending time working in the laboratory of an anatomist tracing the path of bundles of nerve fibres in the human brain. In 1920, he began to work on a paper, entitled

[4] Of course, Hayek advances his own computational argument against attempts to eliminate references to mental entities from our accounts of human behaviour, by arguing in favour of a mild and 'practical' form of methodological dualism, according to which, in attempting to explain human conduct, social scientists must have recourse to terms that refer to mental phenomena like beliefs, purposes, and intentions. The reason is as follows. Explanation is, for Hayek, a form of classification. However, as Hayek sees things, 'Any apparatus of classification must possess a structure of a higher degree of complexity that is possessed by the objects which it classifies' (1952: 185). Hence, the human brain will be able fully to explain only those phenomena that possess a lower degree of complexity than itself. It follows that the brain will be incapable of fully comprehending itself, in the sense of providing a complete physical classification of its own structure and operation. Consequently, 'in discussing mental processes we will never be able to dispense with mental terms, and we shall have permanently to be content with a practical dualism' (1952: 191) (also see Hayek [1962] 2014: 244, 248-53). The ontological/emergentist argument against the elimination of such terms from explanations of human behaviour complements Hayek's own epistemic argument.

Beiträge zur Theorie der Entwicklung des Bewusstseins, or 'Contributions to a Theory of How Consciousness Develops', in which he set out his views in the field of theoretical psychology (Hayek 1920).

Hayek's paper was inspired by the work of the famed Austrian physicist, psychologist and philosopher Ernst Mach (Hayek [1967a] 1992: 172-73). Although Mach died during World War one, his empiricist ideas continued to be highly influential after the war. For Mach, people are directly acquainted with simple, atomistic sense impressions and it is only by combining these that they come to perceive the physical objects they ordinarily think of themselves as seeing (Mach [1896] 1902). While Hayek greatly appreciated Mach's insights into the key problems of psychology, he argued that the philosophical framework within which Mach couched his ideas undermined his efforts to develop convincing solutions to them (1920: 31 n. 26; 1952: 175-76).[5] In particular, Hayek rejected the view that sensations are simply aggregates of pure, atomistic sensory elements whose properties are independent of their mutual relations. Hayek's earliest writing in psychology was motivated by his 'scepticism about Mach's phenomenalism, in which pure, simple sensations are the elements of our entire sensory perceptions' (1992d: 174). In fact, as Hayek—and others, such as Uttal (2000: 48-49, 54-55) and Ash (1995: 87-90)—have noted, in practice Mach himself departed from the atomistic approach he 'officially' espoused, and which is often attributed to him by others, by acknowledging the importance of the relations between sensory elements. Indeed, Hayek's own approach was driven by the realisation that, if the generation of the sensory order was to be understood, it would be necessary to acknowledge explicitly Mach's own departures from a strictly atomistic approach,

[5] When Hayek (1952: 176 n.1) comments that, for all his excellence as a psychologist who was able to formulate many of the most pressing problems of psychology, Mach 'had a philosophy which made it impossible to give fruitful solutions to these problems', it is in large part Mach's residual atomism that he is criticising.

to recognise the importance of the relational view towards which even Mach had begun to veer, and to develop more fully the resultant relational view of the mind. 'I had the revelation,' Hayek wrote, 'that Mach's concept of "simple and pure sensations" in his sensory psychology was actually meaningless. Since Mach had qualified so many of the connexions between sensations as "relations", I was finally forced to conclude that the whole structure of the sensory world was derived from "relations" and that one might therefore throw out altogether the concept of pure and simple sensations, which plays such a large role in Mach' (1992d: 174). It is upon the task of developing a fully-fledged relational account of the mind that Hayek embarked in the *Beiträge*.[6]

Hayek contended in particular that the sensory qualities we experience and upon the basis of which we differentiate between external stimuli depend not upon the individual nerve impulses generated by stimuli *per se* but rather on the location within the central nervous system of the nerve fibres that carry the impulses in question. And he proposed to outline the physiological processes—which he termed 'uptake' processes—through which external stimuli generate the sensory world we actually experience (1920: 1-9, 36-37). The account advanced by Hayek contains most of the key elements of the theoretical psychology set out in *The Sensory Order*. In particular:

- Hayek argued that a satisfactory understanding of the origins of the sensory order required an account of the physiological 'uptake' processes whereby undifferentiated nerve impulses are converted into the sensory qualities we experience or—as Hayek termed them in the *Beiträge*—'consciousness phenomena' (1920: 1, 2).

[6] A referee suggested a complementary account of the significance of Hayek's immanent critique of Mach. This is that Hayek accepted the broad thrust of Mach's anti-metaphysical, positivistic philosophy of science but perceived the consistency between that position and Mach's reliance in his psychology on the untestable metaphysical construct of a 'pure core of sensation'. In seeking to eradicate that notion from his own theoretical psychology, therefore, Hayek was seeking a more thoroughgoing and internally consistent empiricism.

- The ‘uptake’ process, whereby nerve impulses are ‘incorporated into consciousness’ so as to produce the phenomenal world of the senses, centres on the operation of a physiological mechanism that consists of a ‘structural network’ of neurons (1920: 3-4, 10, 23).
- This network has been formed through the creation of connections or ‘linkages’ between neurons that are activated together as a result of the stimuli received by the person over his/her lifetime (1920: 4-5, 7, 11-12).
- As a result of the interconnections existing between neurons, the activation of one nerve by an external stimulus will in turn lead to the activation of a ‘resonance’ or ‘field of uptake’ of linked neurons (1920: 5-8, 29, 31, 34).[7] This transmission of impulses from the nerve that is initially stimulated to its field of uptake is, according to Hayek, central to ‘the process whereby the physiological elements in the brain are converted to attributes of consciousness’ (1920: 6).
- The reason is that, for Hayek, different external stimuli appear differently to us if and only if they generate different uptakes or patterns of impulses within the central nervous system. It is in virtue of the identify of, or the differences between, the uptake fields or resonances set in train by external stimuli that those stimuli give rise to the same, or different, sensory qualities: ‘The excitement of a [nerve] … cell … produces a consciousness entity only by its insertion into the whole nexus by the linkages it acquires and that allow its uptake … The psychic content of an impulse depends not on the impulse as such but [on] how it resonates with other impulses, that is, on whatever field of uptake it has acquired … Insertion into the system or uptake may involve a greater or

[7] The terms ‘resonance’ or ‘field of uptake’ describe what in *The Sensory Order* Hayek would refer to as the ‘following’ of the initial nerve impulse (1952: 64; also see Hayek 1945: 16, paragraph 93).

> lesser degree of differentiation … [and it is] the degree of differentiation attained by specific impulses representing an external stimulus in the brain … [that] can be designated as sensations' (1920: 15-16, 11).

In this way, Hayek achieves his goal in the *Beiträge*, namely that of showing how the phenomenal world we experience arises as a result of physiological processes that convert stimuli into sensory qualities (1920: 1).

For Hayek, therefore, far from being attached in a one-to-one fashion with particular kinds of external stimuli**,** different types of sensory quality are a product of the internal structure or organisation of the nervous system and are therefore relational rather than atomistic in nature: 'From a physiological point of view, it is this system of relationships [between neurons] that constitutes consciousness … The primary phenomenon is the linkage of physiological elements, while all psychic phenomena stem from this linkage' (Hayek: 1920: 10-11, 8).

3.2 'Emergence' in the *Beiträge*

While Hayek does not use the term 'emergence' in the *Beiträge,* it is clear enough that his account is one that treats the capacity to generate the phenomenal world of the senses as being in effect an emergent property of the human nervous system. The ability to discriminate between stimuli and thereby to generate sensory qualities arises only when nerve fibres are arranged in such a way that some stimuli gave rise to different 'resonances' or 'fields of uptake'. Hence the importance Hayek accords to the linkages or interrelations between nerve fibres in his account of the production of sensory qualities and their presentation to consciousness. As he puts it, it is '[t]he totality of these linkages, which determines the quality of each impression and the reaction

it evokes' (Hayek 1920: 26). It follows that the capacity to create the phenomenal world we experience in consciousness is an emergent property of the structured arrangement of neurons found in the human nervous system.

Hayek (1920: 6) elaborates on the relational—or, as it might be put, emergent—character of 'the process whereby the physiological elements in the brain are converted to attributes of consciousness' by noting that 'the special character and significance of a given element for the functioning of the entire system are determined by many other elements, which are activated by this element and represent its functioning within the totality.' Significantly, in considering this process, Hayek refers favourably to the work on Wilhelm Wundt on 'assimilation', that is on how the brain transforms and integrates perceptual information so as to create the consistent and meaningful patterns people actually perceive (1920: 6 n. 4; also see 1952: 150). This is an important reference for our present purposes because, as we shall see, Wundt's theoretical approach was informed by the notion of emergence and it is arguably through Wundt's work that Hayek first came to rely on that concept.

It is worth noting at the outset that while the scholarly literature is clear about the way in which Hayek's thought was shaped by Mach, as at least ostensibly the exponent of the position against which Hayek was arguing, far less attention has been devoted to other authors who might have affected Hayek's new relational thinking in a positive way. Hayek himself does not give us much to go on,[8] but—especially for the purposes of this paper's attempt to understand the origins

[8] As the historian of psychology Edwin Boring put it in his review of *The Sensory Order*, 'I tear my hair out at [Hayek's] lack of historical orientation in psychology. Even when he is right (and that, I should say, is most of the time), you wish he would do a reasonable share of the work in connecting up his thought with that of his predecessors. Physical theories of mind and consciousness, and relational theories, are not new, and one would like to be shown, not merely the content of Hayek's mind, but his theory in the perspective of the history of scientific thought about these matters' (Boring 1953: 183).

of Hayek's reliance on the notion of emergence—some tentative conjectures can be made. These centre on Wundt's influence on Hayek's theoretical psychology.[9]

Wundt was one of the founders of the discipline of psychology and established the first formal laboratory of experimental psychology.[10] Like Hayek, Wundt rejected associationist psychology's claim that people's experiences can be reduced to atomistic sensations, arguing to the contrary that, 'There are absolutely no psychological structures that can be characterised in their meaning or in the value of their contents as the sum of their elemental factors or as the mere mechanical results of their components' (Wundt, quoted in Blumenthal 2001: 130). Wundt argued instead that the generation of sensory qualities involves a 'creative synthesis' such that our mental lives have properties that are qualitatively distinct, and unpredictable, from simple atomistic sensations and physical processes taking place in the brain:

> [W]herever we may look around in the vast domain of mental psychic phenomena in general, their most salient characteristic … is that the product arising from any number of elements is greater than the mere sum of the elements, that it is more than a product of the same kind as the elements ... and is really a new structure … which so far as its essential properties are concerned is not to be compared with the factors that cooperated in its production. We will call this peculiarity of psychic occurrence the principle of *creative resultants*. (Wundt, quoted in Wheeler 1928: 60-61; also see Wheeler 1928: 15)

[9] In the Preface to *The Sensory Order*, Hayek lists Wundt as one of the five main scholars whose work had having shaped his understanding of theoretical psychology when he was writing the *Beiträge* (1952: vi).

[10] More detailed accounts of Wundt's thought, upon which the brief sketch provided in the main text draws, can be found in Blumenthal (2001) and Danziger (2001).

In this way, as Wundt put it, he came 'to conceive of perception as an act of *creative synthesis* … I saw that the old theory of associationism is no longer tenable. It must be replaced by the notion of relational processes' (Wundt, quoted by Blumenthal 2001: 130-31).

In developing his account of the role of 'creative synthesis' or—as he later terms it, 'the principle of creative resultants'—in the generation of the sensory order, Wundt drew on Mill's notion of chemical combination (that is, the idea that when two substances are combined, then a new substance can emerge that has different properties from those possessed by its constituent parts). Of course, as is well known, Mill's ideas about chemical—as distinct from mechanical—combination are one of the wellsprings of the notion of emergence. In drawing on Mill, therefore, Wundt is effectively developing an emergentist account of the mind. Indeed, it is not going too far to say that, for Wundt, the sensory qualities we experience are emergent properties of the neural activity taking place in people's brains. In particular, *apperception*—the term that Wundt uses to denote the identification and grouping by the brain of sense data so that people obtain coherent interpretations of reality—is an emergent capacity of the structured array of neurons in the brain (Blumenthal 2001: 129-31; Danziger 2001: 78-79; also see Ash 1995: 60-62).

The fact that Wundt develops an emergentist account of consciousness is significant for our present purposes because Hayek draws on Wundt's notion of 'creative synthesis' in the *Beiträge*. In a discussion of abstract and conceptual thought—or 'generalised consciousness content', as Hayek terms it—he writes as follows:

> The reason that the recognition of similarities or abstraction [between different impressions] is fraught with difficulties is because the consciousness quality of each

> individual element fails to explain how a constellation of elements (such as a Gestalt) can possess a completely new quality that differs from the sum of the individual impressions, a quality that may even belong to some other constellation which is independent of these impressions. What gives rise to this creative synthesis (Wundt), which underlies abstraction? (Hayek 1920: 30.)

The answer, Hayek concludes, lies once more in an appreciation of the importance of the similarities or differences between the fields of uptake between impressions (1920: 31-32). In other words, for Hayek just as for Wundt, consciousness is the outcome of a 'creative synthesis' produced by the structured interaction of simple neural elements. And while the evidence could hardly be described as conclusive, Hayek's references to Wundt do provide some grounds for thinking that it was from that author that the concept of emergence was imported, under the guise of the notions of 'creative synthesis' and of 'assimilation', into Hayek's theoretical psychology.

4. INFLUENCES ON HAYEK'S USE OF EMERGENCE PART II: *GESTALT* PSYCHOLOGY

Hayek laid the *Beiträge* aside in September 1920 and did not revisit it for over twenty years (Caldwell 2004a: 137). He only returned to his student essay in the mid-1940s, motivated by a desire to find a justification for his own preferred subjectivist approach to economics in the face of claims, underpinned by behaviourist psychology and physicalist philosophy of mind, that

references to subjective states of mind are unscientific and so unwarranted (Caldwell 1994, 2004b: 246-48).

In the course of working up his original paper for publication, Hayek began to catch up on some of the work carried out in the intervening years, most notably for our present purposes by reading the work of the gestalt psychologists (Hayek 1952: v-vi). The significance of gestalt psychology lay in how it helped Hayek to explain with greater clarity and precision than hitherto the fact that the problem addressed by his theoretical work was nothing less than the age-old problem of the relationship between mind and body. What is especially significant for the purposes of the present paper, it will be argued below, is that the formulation of the mind-body problem developed by the gestalt psychologists, and assimilated by Hayek, is one that portrays the mind as an emergent property of the structured array of neurons found in the human brain. In drawing on gestalt psychology in order to conceptualise the relationship between mental and physical events, therefore, Hayek was developing his theoretical psychology in a way that encouraged him to conceptualise and express his ideas within an emergentist framework.

4.1 Gestalt psychology: A summary

Gestalt psychology originated in the second decade of the twentieth century, as a reaction to associationist psychological theories—prominent amongst them Mach's—which claimed that mental experiences such as perceptions could be reduced to, and analysed solely in terms of, elementary atomistic sensations (Köhler 1947: 173). The principal early developers, exponents and champions of gestalt psychology were Max Wertheimer, Wolfgang Köhler, and Kurt Koffka, while important precursors in late nineteenth century Germany included Wilhelm Wundt

and Christian von Ehrenfehls (Smith 1988; Ash 1995; Uttal 2000: 54-56; De Vecchi 2003: 137-41).

The key premises of the gestalt school were twofold. First, the members of the gestalt school argued that the basic unit of perception is not an isolated, independent sensation but rather a configuration or structured group of sensations—known as a *gestalt*—that is quite distinct from, and irreducible to, the sum of the experiences associated with each individual stimulus taken in isolation. According to the gestalt school, sets of stimuli act as 'organised wholes' in the sense that their impact on people's perceptions depends upon their mutual relations. The 'units of perception' are wholes such as 'squares' or 'triangles', not simple sensory elements. On this view, rather than first perceiving isolated, atomistic sensations which they subsequently associate with each other to obtain the sensory world of experience, people simply perceive patterns, experiencing the world as consisting of structured wholes from the very outset (Bertalanffy 1952: 189-92; cf. Hayek 1952: 13-14). The second key tenet of gestalt psychology is the claim that the process of organisation through which these wholes are formed does not inhere in the stimuli themselves but is instead the product of the organising capacity of the human nervous system. Things appear to us the way they do because of the way the human nervous system organises the stimuli so as to produce the sensory world—including the 'wholes' such as 'tables'—that we actually experience (Koffka 1935: 79-80, 99, 378-79; Köhler 1947: 67-69, 103, 153-173, 177-78, 196-99, 236-37).

The conclusion that gestalt psychologists drew from these two premises is that the sensory qualities we experience at a particular moment are the result of the particular configurations—the particular patterns or ordered arrangements—of neural events that are exciting our nervous system at that time. Those gestalten are the product of the way in which the

human nervous system organises stimuli into ‘wholes’. And the properties of those wholes—in particular, their capacity to give rise to certain kinds of sensory quality or mental experience—are quite different from the properties of the individual stimuli taken in isolation. The existence of such a difference—between the properties of a whole and the properties of its individual parts taken in isolation—is, of course, the hallmark of emergence. For gestalt psychologists, therefore, mental phenomena such as the sensory qualities we experience are emergent properties of the activity of the structured configuration of neurons in the human brain. Indeed, the term ‘gestalt’ means ‘organised whole’ or ‘structure’ and refers to situations when the parts identified individually have different properties to the whole, so that the term becomes almost synonymous with the notion of emergence (Köhler 1930: 144-48, 1947: 67-69, 160-69; Koffka 1935: 144-48; also see Bertalanffy 1933: 50, 52, 1952: 189-92, Ash 1995: 171-73).

4.2 Gestalt psychology’s influence on Hayek

While the basic ideas expressed in *The Sensory Order* were developed in the early 1920s, and while Hayek declared that he did not appreciate the significance of the work of the gestalt school until after he had completed the *Beiträge* (1952: v-vi), Hayek also stated that gestalt psychology made an important contribution to the development of the final version of his book. In particular, Hayek reported that the ideas of the gestalt school enabled him to increase the clarity and precision with which he expressed the problem he was seeking to address in *The Sensory Order*:

> The [1920] paper ... contains the whole principle of the story I am now putting forward ... though I felt that I had found the answer to an important problem, I could not explain precisely what the problem was ... I feel that during those years I have

> learnt at least to state the nature of the problem I had been trying to answer. (Hayek 1952: v)

More specifically, while by 1952 Hayek believed that he had been able to (a) state clearly and precisely the problem of the nature of mental phenomena and of their relation to physical events, (b) outline the general principles of a solution to that problem, and (c) derive some of the implications of that solution for epistemology and scientific methodology, it was only the second of these results that he had achieved in his 1920 paper (De Vecchi 2003: 140-41).

In particular, as De Vecchi has argued in an interesting and important paper, the work of the gestalt school enabled Hayek to pin down the meaning of the terms ‘mind’ and ‘body’ and thus to clarify the nature of the entities whose relationship he was considering, thereby helping him to show how the mind-body problem could be formulated in such a way that his theoretical framework could fruitfully be brought to bear upon it (2003: 143-47). The reason is as follows. As noted above, gestalt psychologists like Köhler and Koffka began from the empirical finding that groups of physically different external stimuli can evoke the same sensory qualities, and so be perceived as alike, while groups of physically identical stimuli may be perceived differently, giving rise to dissimilar sensory qualities (Köhler 1947: 93-94, 120-21, 165). It follows that external events can be classified differently, depending on whether the criterion used is their effect upon each other or their impact upon an observer. In the first instance, they appear as physical events, whilst in the second they count as mental events. Herein lies perhaps the major contribution that the work of the gestalt psychologists made to the development of Hayek’s thinking between the *Beiträge* and *The Sensory Order*; their distinction between the two criteria by reference to which events can be classified, namely with regard to their effects upon each

other or with respect to their impact on a human observer, enabled Hayek to pin down the meaning of the terms ‘body’ and ‘mind’: ‘body’, Hayek could then say, is any event ‘defined exclusively in terms of [its] relations’ with other events (1952: 174); while ‘mind’ is that ‘particular order or set of events taking place in some organism and in some manner related to but not identical with, the physical order of events in the environment’ (1952: 16, 19; also see pp. 3-4, 14-16).

Significantly, framing the relationship between the physical and the mental in this way immediately gives rise to the question of why the two frames of reference produce different classifications of events:

> The problem which the existence of mental phenomena raises is therefore how in a part of the physical order (namely an organism) a sub-system can be formed which in some sense (yet to be more fully defined) may be said to reflect some feature of the physical order as a whole, and which thereby enables the organism which contains such a partial reproduction of the environmental order to behave appropriately towards its surroundings. (Hayek 1952: 16)

It is the task of theoretical psychology to explain how it came to be that the sensory or phenomenal order that each of us experiences differs from the physical order. And because it is the central nervous system that receives stimuli from the external world and transforms them into what we experience, it is there that any such investigation must begin. This is, of course, the question that—by the time he was working up his student manuscript into *The Sensory Order*—Hayek realised was the one he was trying to answer.

In this way, *gestalt* psychology helped Hayek to formulate more precisely than he could in 1920 the problem to which his theoretical psychology offered the solution. As Hayek put it, 'Before we can successfully ask how two kinds of events are related to each other (or connected with each other), we must have a clear conception of the distinct attributes by which they can be distinguished. The difficulty of any fruitful discussion of the mind-body problem consists largely in deciding what part of our knowledge can properly be described as knowledge of mental events as distinguished from our knowledge of physical events' (1952: 1). As we have seen, it is this difficulty—of finding a principled way of defining, and distinguishing between, mental and physical events—to which gestalt psychology provided the solution. And it is because of the way in which gestalt psychology enabled him to clarify the nature of the problem that the theoretical principles he outlined in 1920 enabled him to address that Hayek was able to write in 1952 that the problem tackled in *The Sensory Order* was the one that falls under the 'traditional heading ... of the "relation" between mind and body, or between mental and physical events' (1952: 1).

The question to which this naturally gives rise is, what is the nature of the "relation" between mind and body? How is that relation to be conceptualised? The answer, of course, is in terms of emergence. For, as we have seen, gestalt psychology suggests that our sensory experiences are the emergent product of the result of the particular configuration or ordered patterns of nerve firings that place in the nervous systems. As Hayek stated in *The Sensory Order*, it is largely due to the work of the gestalt school that it has been realised that 'in perception we do not merely add together given sensory elements, and that *complex perceptions possess attributes which cannot be derived from the discernable attributes of the separate parts*' (1952: 76; emphasis added). This distinction between the attributes or properties of complex perceptions, on the one hand, and the attributes or properties of their parts, on the other, is a

reference to emergence in all but name. In other words, according to Hayek, it is largely through the work of the gestalt school that the fact that perception is an emergent product of the operation of our nervous system, so that sensory qualities can be understood only relationally, not atomistically, came to be appreciated.[11]

Hayek elaborates on this point, using his new definitions of 'mental events' and 'physical events' as follows:

> Our view agrees, of course, with associationism in the endeavour to trace all mental properties to connexions established by experience between certain elements. It differs from it by regarding the elements between which such connexions are established as not themselves mental in character but as material events which only through those connexions are arranged in a new order in which they obtain the special significance characteristic of mental events. (Hayek 1952: 151)

By 'an order of events,' Hayek (1952: 46-47) means 'something different from the properties of the individual events … An order involves elements *plus* certain relations between them.' This is a topic to which we shall return in the next section of the paper. For the moment, it suffices to note that, for Hayek, the elements out of which mental events arise are material events, namely nerve impulses, and it is only when those nerve firings take place within the structures formed by the ordered arrangement of neurons found in the human brain that 'mental events' arise. Those mental events, therefore, are emergent properties of the structured arrangement of neurons.

[11] Hayek elaborates on these issues later in his career, most notably in his 1962 essay, 'Rules Perception and Intelligibility'. In that essay, he draws on the work of the gestalt psychologists amongst others to argue that people are able to perceive and learn patterns of (rule-governed) action in the conduct of others, and thereby to identify the meaning of those actions, without also being aware of the individual actions of which that pattern is composed Hayek [1962] 2014: 234-38, 241-42, 247). He then goes on to explore the neural mechanisms that account for that ability (Hayek [1962] 2014: 239-41).

Additional evidence in support of the interpretation advanced here is provided by the way that Hayek goes on to observe that gestalt psychologists refer to the process through which the human nervous system integrates the individual nerve firings into 'wholes' or 'configurations' so as to give rise to the phenomenal world of sensory experience as the 'organisation of the field'. More specifically, Hayek acknowledges that that it is '[a]s a result of the work of the gestalt school [that] the view has now become widely accepted that sensory qualities must not be regarded as atomic fact but should be conceived as determined by the "organization of the field"' (1952: 77). Hayek describes the connection between his work and that of the gestalt school as follows:

> [T]he present approach may be regarded as an attempt to raise, with regard to all kinds of sensory experiences, the question which the gestalt school raised in connexion with the perception of configurations. And it seems to us, that in some respects at least, *our theory may be regarded as a consistent development of the approach of the gestalt school*. (Hayek 1952: 151; emphasis added; also see Hayek [1969] 2014: 317.)

The remarks quoted above about the importance of the 'organization' of the network of nerves through which impulses travel in the brain for the determination of the sensory world people experience, taken together with Hayek's earlier reference to the existence of differences between the attributes or properties of complex perceptions and the attributes or properties of their individual parts, indicate that Hayek is relying here on the concept of emergence in all but name. And his description of his work as a 'development of' the work of the gestalt school suggests

that the latter provided an important part of the foundations upon which Hayek built his theoretical edifice, in particular by encouraging and reinforcing Hayek's use—albeit unchristened—of the notion of emergence.

On the view outlined here, therefore, Hayek's reading of the work of the gestalt psychologists further embedded the notion of emergence in his theoretical psychology, in particular by encouraging him to view the task of specifying the relationship between mental and physical events not only as the central problem to which his theory provided the solution but also as a relationship best conceived in terms of emergence. Mental events, Hayek came to believe, are emergent from the physical events occurring in the structured array of neurons found in the human nervous system. Alternatively put, mind is an emergent property of the physical structures found in the human brain.

This is not, however, the end of the story of the inter-relationships between Hayek's cognitive psychology and gestalt psychology. It will not have gone unnoticed that Hayek refers to his work as a *development* of the work of the gestalt school. The notion of 'development' is, of course, double-sided. As noted above, it implies that the ideas of the gestalt school helped to provide some of the building blocks of Hayek's scheme of thought, most notably his definitions of 'mind' and 'body' and his account of the relation between the two as centring on the notion of emergence. In addition, however, the notion of 'development' suggests too that Hayek believed that, by building on the ideas of the gestalt psychologists, he was also moving beyond, and surpassing, their work. As Hayek wrote:

> It may be suggested that the theory of the determination of the sensory qualities here developed gives this somewhat vague conception of the 'organisation of the field' a

> precise meaning; and, at the same time, that it takes this whole approach some steps further by making it clear, firstly, that the 'organisation of the field' is based on, and is in principle capable of explanation in terms of, causal connexions between physiological impulses; and, secondly, that this organisation of the field is not additional to the qualities of any kind of atomic sensations … but that it is the structure of the field which determines the peculiar functional significance of the individual impulse, or group of impulses, which we know as their sensory qualities. (Hayek 1952: 77; also see Hayek [1969] 2014: 316-18)

Hayek's goal is to identify the causal mechanism through which the interaction of suitably structured neuronal parts give rise to the emergent capacity of the nervous system as a whole to generate sensory qualities. To paraphrase Donna Haraway's comment on the biologist Ross Harrison—a member of the so-called organicist school of biology, to which we shall return in the next section—'organisation' and 'wholeness' were for Hayek not answers to psychological questions; they *were* the psychological questions *par excellence* (Haraway 2004: 83, also see pp. 105, 130; cf. Ash 1995: ix, 11). That is to say, the importance of organizing relations, and the existence of structural or emergent properties, should not simply be taken as given but rather should be explained through a causal analysis of how the elements in question interact with each other when they are related to each other in the appropriate way so as to give rise to the emergent property in question.

Arguably, Hayek's attempts to answer these questions by analysing the notions of 'organisation' and 'structure', and therefore his understanding of the notion of emergence, were aided by his reading in the mid-to-late 1940s of the work of two prominent members of the so-

called organicist school of biology, namely the theoretical biologist and founder of systems theory Ludwig von Bertalanffy and the theoretical biologist and philosopher of biology Joseph Woodger. Both men argued for an 'organicist' perspective that emphasised the importance for developing a satisfactory understanding of the biological world of adopting theoretical frameworks that do justice to processual change, internal (organising) relations, and structural (emergent) properties. As we shall discover, their influence on Hayek's thinking can be seen most clearly in the development of his work on theoretical psychology between his 1945 manuscript *What is Mind?* and the final version of *The Sensory Order*.

5. INFLUENCES ON HAYEK'S USE OF EMERGENCE PART III: BERTALANFFY, WOODGER, ORGANICIST BIOLOGY, AND SYSTEMS THEORY

5.1 Joseph Woodger, Ludwig von Bertalanffy and organicist biology: An outline

Bertalanffy and Woodger were writing in the 1920s, at which time biology was in the thrall of the so-called mechanism-vitalism controversy. Inspired by classical physics, and by philosophers such as Descartes, the advocates of the mechanistic approach argued that biological systems are best understood by reducing them to their smallest constituent parts. On this view, biology would end up being nothing more than a branch of physics, with explanations of biological phenomena being couched in terms of the behaviour of isolated elementary physical particles. The flaw in such a reductionist perspective, Bertalanffy and Woodger argued, was that—as we shall elaborate below—it fails to do justice to the profound importance of the relations obtaining between those basic elements for a satisfactory understanding of complex biological phenomena.

Vitalists contended that, far from being explicable in terms of isolated atomic causal processes, biological phenomena can only be understood if it is acknowledged that there exists some supernatural force, existing independently of the material world, that animates and gives life to the biological world. The problem here, according to Bertalanffy and Woodger, is that while vitalism 'recognises the character of organic order and wholeness' of the biological world, it lacks the concepts—such as 'organisation' and 'emergence'—required adequately to theorise those aspects of the natural world and so has little option but to attribute them to 'a metaphysical or psychical factor'. As a result, 'Vitalism means nothing less than a renunciation of a scientific explanation of biological data' (Bertalanffy 1933: 46, 45) (Bertalanffy 1933: 28-32, 43-50, 177-78, 188, 1952: 1-9; Woodger 1929: chapter 5, 275, 286-99).

Bertalanffy and Woodger sought to transcend the terms of this debate by developing a conception of the biological world that, by emphasising the importance of the structural relations obtaining between the parts of an organism (and the attendant notions of emergent properties and levels of organisation), would avoid the shortcomings of the mechanistic approach without lapsing into metaphysical excesses of vitalism. This new perspective, distinct both from mechanism and also from vitalism, was known as organicism (Bertalanffy 1933: 46; also see Bertalanffy 1969: 89-90). The term 'organicism' was intended to highlight in particular the importance of *organisation*—that is, of the relations obtaining between the parts of an organism—and also (relatedly) of the relative autonomy of biology with respect to the physical and chemical sciences (Wheeler 1928: 53-74; Bertalanffy 1933: 8-10, 28-66, 1952: 9-54, 1969: 12; Hammond 2003: 104-05, 111-15; Haraway 2004: 26-29, 33-63).

On this view, the organisation or set of structural relations obtaining between the parts of an organism is critical for understanding the behaviour of complex biological phenomena

(Bertalanffy 1950: 148). Reductionist approaches neglect or deny 'the essential characteristic of living things as such – the arrangement or organization of materials and processes' and, in particular, the way in which it is only when physio-chemical materials are organised so as to form a particular structure that the key properties of living organisms arise at all: '[I]n this sense,' Bertalanffy (1933: 35) argued, using a phrase to which we shall return below, 'life *is* more than a heap of physical and chemical processes and has its "own laws".' It follows that biological properties cannot be reduced to, or comprehended solely in terms of, aggregates of isolated physio-chemical processes. Rather, they are *gestalten* or system-level properties borne by the structured wholes that obtain when physio-chemical materials and processes are organised so that they stand in certain relations to one another. As Woodger put it, in a passage drawn from a section of his *Biological Principles* that—as we shall see—is referenced by Hayek in *The Sensory Order*,

> just as molecules … have different properties from their atoms, so do the organised parts of the organism … have characteristic properties which can only be discovered by studying such parts [of the organism] themselves, not only by studying their constituent molecules ... There is a hierarchy of composing parts or relata in a hierarchy of organising relations. These relations and relata can only be studied at their own levels … and not simply in terms of the lower levels … [so that with each new level] new types of regularity or law have come into being. (Woodger 1929: 287-88, 293, 316.)

For both Woodger and Bertalanffy, then, organisation is a hallmark of living systems. On this view, biological organisms consist of a nested hierarchy of organised parts or systems, with smaller systems existing within the context of larger ones in a ladder of levels of organisation from the atomic to the molecular to the cellular to—ultimately—the organismic, each with its own distinctive and irreducible properties (Woodger 1929: 283-99, 310-17; Bertalanffy 1933: 8-10, 51-53, 1952: 181).

In the late 1930s and 1940s, Bertalanffy extended this emphasis on the importance of the relational organisation of phenomena into 'wholes' exhibiting emergent properties from the biological to the physical, psychological and social realms. His goal was to develop a trans-disciplinary framework—couched in terms of concepts such as 'organisation', 'level', and 'emergence'—that was applicable to all phenomena of organised complexity, independent of their substance or spatio-temporal sphere of existence. Bertalanffy termed his framework, general system theory. System theory adopts a holistic approach that—in contrast to the reductionism inspired by classical mechanics—emphasises (i) the explanatory significance of the relations that obtain between the elements or parts of physical, biological, and social systems for our understanding of the latter's properties and behaviour, (ii) the way in which, based upon their emergent properties, systems interact with their environment, leading to continual evolution, and (iii) the epistemological independence ('autonomy') of the different disciplines (Bertalanffy 1950: 164-65, 1969: 34; Hammond 2003: 103-41).

5.2 Influence on Hayek

There are three pieces of evidence which suggest that the organicist biologists influenced Hayek's use of the notion of emergence. The first reference to their work comes in the second

section of chapter 2 of *The Sensory Order*, in a section where Hayek is discussing the kind of explanation of the working of the mind that he is trying to develop. In a series of four paragraphs (2.27-2.30), Hayek elaborates on the nature of this explanation of the sensory qualities people experience by referring to the notion of emergence in all but name (Hayek 1952: 46-47). It is worth noting at the outset that the material contained in the four paragraphs in question cannot be found in an earlier manuscript version of *The Sensory Order*, namely *What is Mind?* (Hayek 1945). It appears, therefore, that Hayek added the material on emergence and structural properties between drafting *What is Mind?* in 1945 and completing the final manuscript of *The Sensory Order* in 1952. Given that, as well shall see, he references sections of the work Bertalanffy and Woodger where they explicitly discuss the concept of emergence, it seems reasonable to suppose that their addition came as a result of his reading their work.

The first of the four paragraphs begins as follows:

> The apparent paradox that certain relations between non-mental events should turn them into mental events resolves itself as soon as we accept the definition of the mind as a peculiar order. (Hayek 1952: 46.)

This sentence refers, of course, to the way in which the clarification of the meaning of the terms ‘mind’ and ‘body’ by the gestalt psychologists had made it possible for Hayek to see how the mind-body problem can be appropriately formulated and, therefore, assimilated to and dealt with by his theoretical psychology. Hayek elaborates on how this can be done by alluding to the notion of emergence:

Any individual neural event may have physical properties which are similar or different from other such events if investigated in isolation. But, irrespective of the properties which those events will possess by themselves, they will possess others solely as a result of their position in the order of inter-connected neural events … [A]n order of events is something different from the properties of the individual events … [T]he peculiar properties of the elementary neural events which are the terms of the mental order have nothing to do with that order itself. What we have called physical properties of those events are those properties which will appear if they are placed in a variety of experimental relations to different other kinds of event. The mental properties are those which they possess only as a part of the particular structure and which may be largely independent of the former … That a particular order of events or objects is something different from all the individual events taken separately is the significant fact behind the endless and unprofitable talk about "the whole being greater than the mere sum of its parts". Of course an order does not arise from the parts being thrown together in a heap, and one arrangement of a given set of parts may constitute something different from another arrangement of the same set of parts. An order involves elements *plus* certain relations between them, and the same order or structure may be formed by any elements capable of entering into the same relations with each other … [I]t is only when we understand how the elements are related to each other that the talk about the whole being more than the parts becomes more than an empty phrase. All that theoretical biology has in this respect to say on the significance of structural properties as distinct from the properties of the

> elements, and about the significance of "organization", is directly applicable to our problem. (Hayek 1952: 46-47)

In a footnote appended immediately after the reference to "organization", Hayek refers to a section of Woodger's *Biological Principles* where various issues pertaining to emergence are discussed, such as the distinction between aggregates (heaps) and organised wholes, the existence of hierarchies of organised entities, and the fact that the entities situated at each level of the hierarchy possess properties distinct from those of their lower-level constituent parts (1929: 273-310). In the same footnote, Hayek also refers to the German version of Bertalanffy's *Problems of Life* (1952), in which Bertalanffy uses the notion of emergent properties, and its correlates such as 'levels of organisation', to clarify various issues in theoretical biology and gestalt psychology. The bibliography of *The Sensory Order* also indicates that Hayek read some of Bertalanffy's other writings, mostly notably his 1950 *British Journal for the Philosophy of Science* paper on systems theory, where Bertalanffy discusses structural or emergent properties and levels of organisation in terms that closely resemble those used by Hayek, suggesting again that Hayek's reading of Bertalanffy—as well as of Woodger—enabled him to develop the ideas about relational orders, and their differences with aggregates or 'heaps', expressed in paragraph 2.27-2.30 of *The Sensory Order* (Bertalanffy 1950; Hayek 1952: 195).[12]

It is also worth considering Hayek's remark at the end of the passage quoted in the main text that, 'it is only when we understand how the elements are related to each other that the talk about the whole being more than the parts becomes more than an empty phrase.' This arguably reflects the view of organicists such as Bertalanffy that the importance of organizing relations,

[12] Correspondence between Bertalanffy and Hayek indicates that Hayek read the German version of Bertalanffy's 1952 book in 1947, and that Bertalanffy read and commented on the manuscript of *The Sensory Order* in 1950 (Box 12, folder 4) (also see Hayek 1952: viii-ix).

and the existence of structural properties, should not simply be taken as given but rather should be explained by examining how the elements in question interact with each other when they are related in the relevant way (rather than by referring to new substances or non-material life-giving forces and thereby lapsing into vitalism). As Bertalanffy put it in the 1950 article referenced by Hayek, 'The central position of the concept of "wholeness" in biology, psychology, sociology and other sciences is generally acknowledged. What is meant by this concept is indicated by expressions such as "system", "organism", "interaction", "the whole is more than the sum of its parts" and the like. However, these concepts have often been misused, and they are of a vague and somewhat mystical character' (1950: 142). Bertalanffy sees his task as that of clarifying, and making more precise, the meaning of such terms, and it is perhaps not too much to suggest that Hayek's remarks about the need to clarify the meaning of phrases such as 'the whole is greater than the sum of its parts' were informed by Bertalanffy's views on the matter. In contrast to vitalists, therefore, organicists like Bertalanffy—and, as we shall see below, Hayek—argued that structural properties can be analysed using scientific methods. Bertalanffy goes on to contrast organised wholes exhibiting emergent properties with aggregates or, as he terms them, 'heaps': 'We may define summativity by saying that a complex can be built up, step by step, by putting together the first separate elements; conversely, the characteristics of the complex can be analysed completely into those of the separate elements. This is true for those complexes which we may call "heaps", such as a heap of bricks or odds and ends, or for mechanical forces, acting according to the parallelogram of forces. It does not apply to those systems which we call *Gestalten* in German' (1950: 147). Again, it seems likely that the reference to 'heaps' in Hayek reflects his reading of passages such as this. Hayek's references to Bertalanffy's writings, along with the similarities in the substantive points made and in the terminology used to express them,

again suggests that Bertalanffy's work—along with that of Woodger—helped to shape Hayek's developing thoughts about the importance of (issues connected with) emergence.

The fact that the four paragraphs in which Hayek develops these ideas were added to the manuscript of *The Sensory Order* only after the initial draft of *What is Mind?* was written, taken together with the fact that the works by Bertalanffy and Woodger referenced by Hayek contain accounts of the very concepts and ideas—in particular the notions of internal relations, organisation, structural properties, and hierarchical levels—that Hayek himself discusses in the passages, often using similar terminology to Bertalanffy, makes it plausible to conclude that it is from these authors that Hayek acquired the ideas in question. The fact that these four paragraphs contain the first explicit references in Hayek's writings to the notion of structural properties, and to the possibility that organised wholes may be greater than the sum of their parts, coupled with the references to the (clearly, highly congenial) work of Bertalanffy and Woodger on those topics, suggest that reading those authors enabled Hayek significantly to develop his own understanding of emergence (as involving structural properties, organised parts, etc).

Further support for this interpretation is provided by a remark that Hayek made in 1968, at the Alpbach symposium. The latter was a multi-disciplinary group of scholars who shared the goal of remedying 'the insufficient emancipation of the life sciences from the mechanistic concepts of nineteenth century physics, and the resulting crudely reductionist philosophy' (Koestler 1969: 2). The members of the group aimed to do so by exploring the potential of the organismic paradigm, with its emphasis on organization, emergence, and the hierarchical ordering of the natural and social worlds, in a variety of different disciplinary contexts. The symposium is principally of interest for our present purposes because, in the discussion that followed one seminar presentation, the question of the meaning and usefulness of the term, 'the

whole is greater than the sum of its parts' was raised. Hayek contributed to the debate by making the following remark: 'Do you remember the Woodger discussion on this problem of parts and wholes[?] I thought he gave a perfectly satisfactory explanation' (in Koestler and Smythies [eds.] 1969: 43). This comment clearly implies that Hayek accepted Woodger's account of part-whole relations, which was of course couched in terms of emergence (Haraway 2004: 4-5, 131-33, 15-16, 38, 183-84).

The third piece of evidence in support of the claim that Hayek's views on emergence were shaped by the organicist biologists lies in the way that Hayek postulates a layered ontology, based on 'levels of organization', closely akin to that postulated by Bertalanffy and Woodger. For Woodger and Bertalanffy, this hierarchical order ranges from microphysical particles through molecules and cells to multi-cellular organisms up to and including supra-individual units of life (Woodger 1929: 287-88, 293; Bertalanffy 1952: 23-54, 147-54, 172). Hayek's commitment to a layered ontology can be found in his view that complex systems are hierarchical, with one level of emergent entities constituting the building blocks for the next. More specifically, teaching notes that Hayek produced for a seminar class on 'Scientific Method and the Study of Society', held at the University of Chicago in late 1952, included a chart listing phenomena at different 'levels of organisation'—the very title of chapter 2 of Bertalanffy's *Problems of Life* (1952: 23)—ranging from the gene to the cell to individuals to society, along with the corresponding fields of study (genetics, physiology, etc.) (Hayek archive, Box 63 folders 13 and 14; Caldwell 2004a: 298-99).[13] The distinction between these different levels of organisation and, in particular, the fact that each is allocated its own field of study—rather than it being claimed that higher-level entities can be reduced to the lower-level ones—is, of course,

[13] The chart and the reading list for the seminar can be found in the Hayek Archive (Box 63, folders 13 and 14 respectively). Hayek included Woodger's 1929 book, *Biological Principles*, on the reading list for the seminar.

central to Bertalanffy and Woodger's ideas and lends further support to the view that Hayek's views on emergence were shaped by their work.

It appears, therefore, that in the late 1940s, Hayek read the works of Bertalanffy and Woodger and, through doing so, was able to develop his appreciation of how the arrangement of certain parts or elements so as to form a particular relational order can give rise to structural properties that are quite distinct from the properties of those elements taken in isolation. Quite literally, this is 'emergence' in all but name.

6. CONCLUSION

This paper has sought to trace the origins of the concept of emergence in the work of Friedrich Hayek, most especially in Hayek's writings on theoretical psychology. It has been argued that there are three main sources whereby Hayek became acquainted with, and refined his understanding of, the various aspects of the notion of emergence and through which that concept came to shape his theoretical psychology. The first was the work of the German psychologist Wilhelm Wundt, whose notion of 'creative synthesis' was an influence on Hayek's 1920 student paper on theoretical psychology. More specifically, Wundt's writings on assimilation and 'creative synthesis' helped Hayek to articulate his insight that the similarities and differences in the sensory qualities people perceive are the result of similarities and differences in the overall pattern of nerve firings which external stimuli generate in the structured array of neurons found in the human brain.

The second conduit via which Hayek developed his appreciation of emergence was the work of the gestalt psychologists, the study of whose writings helped Hayek to increase the clarity and precision with which he formulated the nature of the problem he was addressing when he returned to theoretical psychology in the 1940s. In particular, by enabling him to pin down the meaning of 'mental' and 'physical' events, gestalt psychology enabled Hayek to explain more clearly than he had hitherto managed how the theory he had begun to develop as a student in 1920 could be brought to bear on the age-old problem of how to conceptualise the relationship between mind and body. The upshot, Hayek came to believe, was that the relationship between the mind and the body was best conceptualised in terms of emergence, with mind being understood, not as a distinct substance, but rather as an emergent property of the physical structures found in the human brain.

Third, and finally, Hayek's reading of the work of the organicist biologists Joseph Woodger and Ludwig von Bertalanffy made it possible for him to develop further the emergentist account of the mind-body relationship advanced by the gestalt psychologists, in particular by enabling him to clarify their concept of the 'organization of the field'. In particular, the writings of Bertalanffy and Woodger on 'organization', on the difference between 'heaps' or 'aggregates' and relationally-organised 'wholes', on 'systems', and on 'structural properties', enabled Hayek to refine his account of the mind by helping him to conceptualise the difference between mental and physical orders, and the properties thereof, as being one of emergence. And by providing him with the conceptual tools required to unpack and elaborate on the nature and significance of 'emergence', so that invoking the idea of structural or emergent properties becomes a genuinely scientific claim rather than an 'empty phrase', the work of Woodger and

Bertalanffy further contributed to Hayek's understanding of, and reliance on, the notion of emergence.

It is perhaps unsurprising, given the lack of explicit uses of the term 'emergence' in Hayek's writings, that the emergentist themes in Hayek's theoretical psychology have eluded many commentators, both early and more recent in vintage. Three examples will be mentioned here. First, in a review of *The Sensory Order*, the historian of psychology Edwin Boring pointed out what he thought was an inconsistency in Hayek's argument, namely that, 'all through this discussion Hayek talks like a mind-body dualist and yet presently insists that he is not' (Boring 1953: 183). The point, of course, is that Hayek is a property dualist, not a substance dualist: when he 'talks like a mind-body dualist', it is property dualism—that is, the idea that structural arrangements of neurons possess distinctive emergent properties not possessed by individual nerve fibres—he is affirming; and when he 'insists that he is not [a dualist]', it is substance dualism—that is, the idea that there is a distinctive mental 'stuff' of which the mind is composed—he is disavowing. Contrary to Boring, therefore, there is no contradiction or inconsistency in Hayek's position. However, the fact that Hayek's property dualism is grounded in an emergentist account of the mind that he leaves largely implicit is, of course, one reason why commentators such as Boring found it so hard to recognise. Second, and more recently, De Vecchi has argued that 'Hayek must confine himself to rejecting the dualism between mind and body but only from an ontological point of view … [and not] on the gnoseological level, that is, the level of the "scientific explanation" of the events (Hayek 1952, 4, 173, 179)' (De Vecchi 2003: 146). Again, the point is that while Hayek does reject the substance version of ontological dualism, an appreciation of the importance of emergence in his thinking makes it possible to see that he does retain a commitment to another form of ontological dualism, namely property

dualism. And is it this property dualism that underwrites at least in part his anti-reductionism (that is, his determination to retain the mental terminology of 'beliefs', 'desires' and 'purposes' in his 'scientific explanation' of human action). Third, and finally, Birner describes Hayek's theoretical psychology as an example of 'physicalist reductionism' and goes on to argue that, 'What is perhaps most surprising of all about Hayek's psychology in the wider sense of the word, that is, comprising his solution to the mind-body problem, is that in the end it undermines his entire system of thought, except, perhaps, for his economics, which did not undergo its influence. On further analysis, Hayek's physicalist reductionism turns out to be a straightjacket that leaves no room for any active and creative role of man' (1999: 50, 78). The analysis of Hayek's cognitive psychology presented in this paper suggests that Birner is mistaken and that there is no contradiction between his emergence-based solution to the mind-body problem and his wider social and economic theory. For if Hayek's account is one in which the relationship between mind and body is best thought of in terms of the notion of emergence, then one can think of the causal powers of human mind—including not only its capacity to generate the phenomenal world of sensory experience but also its ability to imbue events with subjective meaning and to initiate novel courses of action—as emergent properties of the structured array of neurons found in the human brain and, therefore, as being quite compatible with Hayek's cognitive psychology (Lewis 2012: 372, 2015a). In this way, therefore, the current paper helps not only to identify the sources of a concept that is central to Hayek's account of the mind, but also to correct some common misconceptions about the consistency of Hayek's theoretical psychology, both internally and with respect to his broader social theory.

The issues discussed here also bear upon a recent debate over the development of Hayek's economics after World War Two. In a review of Bruce Caldwell *Hayek's Challenge*

(Caldwell 2004a), Philip Mirowski has argued that Caldwell has both over-stated the degree of continuity in Hayek's postwar thinking about the economy and also has failed in his efforts to portray Hayek as invoking a model of man as a social being. More specifically, in the first place, Mirowski argues that Caldwell underestimates the discontinuity involved in Hayek's transition from the early 1950s, when he "began to endorse various aspects of the 'cybernetics' project, which sought to reduce thought to mechanism" and his later "appeal to 'evolution' to explain how an ineffable complex order, … The Market, could have come about" (Mirowski 2007: 366). Second, Mirowski contends that, under the influence of cybernetics, Hayek engaged in a process of "'ontological flattening' of the 'Thing that thinks' [which] allowed him to blur the level that his analysis operated upon, be it 'brains' or 'individuals' or 'groups' … [H]e was concurrently describing the individual mind equally [with the market] as a machine for registering change. Thus I cannot accept Caldwell's assertion that … Hayek's 'agent is a real human being who inhabits a specific social space, not some atomistic and asocial automaton'" (Mirowski 2007: 366; quoting Caldwell 2004a: 286).

Thinking about Bertalanffy and Woodger's influence on Hayek, in particular the way their work encouraged Hayek to view mental properties as being emergent from, and irreducible to, the behaviour of isolated, atomistic neurons, castes some doubt on whether Hayek was as committed to portraying the mind in mechanistic/atomistic terms as Mirowski claims. We have seen that, as early as the late 1940s, Hayek's thinking was influenced by an approach, organicist biology, that is explicitly anti-reductionist and anti-mechanistic. Moreover, the fact that Hayek's thought about the mind was being shaped by the work of people who employed organicist thinking, drawn from biology, also suggests there is more continuity between that stage of Hayek's thought and his later commitment to evolutionary thinking than Mirowski has

acknowledged.[14] Second, and relatedly, Mirowski's description of Hayek's work as constituting a process of "ontological flattening" that allowed Hayek to "blur the level that his analysis operated upon, be it 'brains' or 'individuals' or 'groups'" is of course apt if—as no doubt Mirowski intended—his goal was to highlight the analogies in Hayek's account between the behaviour of those entities. But Mirowski's claim also obscures the fact that Hayek endorsement of the notion of emergence in his theoretical psychology, and subsequently in his analysis of the market, gives rise to precisely the opposite of a 'flat' ontology. For, as described above, influenced by Woodger and Bertalanffy, Hayek endorses a hierarchical worldview, according to which individuals possessing their own distinctive emergent properties (at one level of reality) constitute the building blocks out of which higher-level groups are formed, with those higher-level systems also possessing their own distinctive emergent properties. And, significantly, Hayek's account is one which implies that the properties of those higher-level entities include the capacity to react back on, and to shape, the attributes of those individuals who comprise the elements from which it is formed, casting further doubt on the claim that Hayek portrays people in atomistic terms (Hayek 1973: 17-18, 1979: 156-59; Lewis 2012: 374-76, 2015a: section 4; also see Dupuy 2009: 156-58). Of course, the issues involved here are subtle, and the brief discussion here is not intended to resolve them. But what is more important for my present purposes is that it demonstrates the relevance of the analysis provided in this paper for those interested in Hayek's economics.

[14] It is noteworthy in this respect that, as a number of commentators have observed, Bertalanffy sought to distance himself from cybernetics, both on the grounds that the latter was too mechanistic, physicalist and reductionist, and also because it dealt with structures that were essentially fixed or pre-established rather than examining how they came into being (Bertalanffy 1952: 132-46, 1969: 15-27, 44, 149-50, 163; also see Davidson 1983: 83-85, 202-09; Dupuy 2009: 131-32; Pouvreau 2009: 116-17, 152-53). Indeed, one of the passages in which Bertalanffy makes the case that science should examine the evolution of structures, rather than treating them as pre-established, is cited by Hayek in the course of his argument that an evolutionary account is required to explain the existence of systems of ruling facilitating social order (Bertalanffy 1952: 134; Hayek [1967b] 2014: 298 n. 16). Thus, as Mirowski himself acknowledges elsewhere, Hayek becomes "an advocate of something verging upon systems theory" (2002: 240). But, as the account provided in this paper suggests, the influence of system theory, and Bertalanffy in particular, can be seen much earlier in Hayek's thinking, in particular in the late 1940s and 1950s and not just "late" in Hayek's career as Mirowski asserts, suggesting both there is more continuity in Hayek's postwar thought, and less reliance on a-social models of man, than Mirowski suggests (2002: 240).

Finally, and as prefigured above, it is also worth observing that the influence of the concepts whose acquisition by Hayek has been explored here, in particular those of 'emergence', 'levels of organisation' and 'system', extends well beyond his theoretical psychology to encompass his economics. For as Hayek wrote to Karl Popper, by the early 1960s he was attempting to restate his insights into the working of the economy using "the conception of higher-level regularities", adding that:

> I suspect it is really what Bertalanffy with his General Systems Theory was after ... It continues to become clearer, though I have not yet got an altogether satisfactory formulation of what I am after. (Hayek to Popper, February 27th 1960, Hayek Collection, box 44, folder 2, Hoover Institution Archives, quoted in Caldwell 2014: 18.)

What we can see, especially in essays such as 'Notes on the Evolution of Systems of Rules of Conduct' ([Hayek] 1967b: 2014), is Hayek using the ideas he acquired from the organicist biologists in particular to express the idea that the coordinative power of the market economy is an emergent or higher-level property, termed 'the overall order of actions', that arises when people's interactions are governed and structured by particular systems of rules.[15] And this

[15] While there is no evidence that there was any correspondence between Hayek and Bertalanffy in the 1960s, the two men did attend at least some of the same conferences. First, in June 1960, both attended the 'Symposium on the Principles of Self-Organization', sponsored by the Information Systems Branch of the US Office of Naval Research and held at the University of Illinois. However, neither gave a paper and the few references to them in the Transactions of the symposium are devoid of interesting intellectual content (see Foerster and Zopf [eds.] 1962, pp. x, 132, 261, 382, 283, 399). Second, and more interestingly, both Hayek and Bertalanffy participated in the 1968 Alpbach symposium, so called because it was held at Alpbach in the Austrian Tirol. The participants in the symposium were concerned to remedy "the insufficient emancipation of the life sciences from the mechanistic concepts of nineteenth century physics, and the resulting crudely reductionist philosophy" (Koestler 1969: 2). Accordingly, they shared a common interest in exploring the potential of the organismic paradigm, with its emphasis on emergence, and the hierarchical nature of the natural and social worlds, in variety of different disciplines. In addition to Hayek and Bertalanffy, participants in the symposium included another of the principal architects of organismic biology, namely the Viennese developmental biologist Paul Weiss, the writer Arthur Koestler, who organised the event, and developmental biologist C.H. Waddington (Haraway 2004: 4-5, 131-33, 15-16, 38, 183-84). The paper Hayek presented at the symposium was 'The Primacy of the Abstract' (Hayek [1969] 2014). Frustratingly, and tantalisingly, for the purposes of the present essay, the first footnote in the version of the paper published in the conference proceeding contains the following

account of the coordinative power of the market as a structural or emergent property in turns forms the basis both (i) for Hayek's theory of group selection, where the traits that form the basis for inter-group competition are the emergent properties that supervene on each group's system of rules, and (ii) also for Hayek's theory of justice, according to which rules are regarded as just precisely in virtue of their capacity to contribute to a rule system that generates the emergent or higher-level capacity to coordinate people's actions (Hayek, 1973: 94-123, 1976: 31-44, 70-73). The point is that the ideas whose entry into Hayek's theoretical psychology is discussed in this paper are also significant both for this economics and also for his political philosophy, so their origins will be of interest for students of this aspects of Hayek's thought as well. But that is a story the details of which must be left until another occasion (Lewis 2015b).

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comments from the editors of the volume: "On the original programme of the conference, Professor Hayek was scheduled to give a paper on 'Group Behaviour and Individual Behaviour' and the applications of the hierarchic concept in the social sciences. In the preamble to his presentation, he explained why he preferred to talk on 'The Primacy of the Abstract' instead. This also explains why, except for references in passing, social science in the narrower sense was not discussed at the Symposium. *Eds*.' (Koestler and Smythies [eds.] 1969: 309 n.1). The editors' comments were, perhaps unsurprisingly, excised from the version of the paper that was reprinted in Hayek's 1978 volume, *New Studies in Politics, Philosophy and Economics* (Hayek [1969] 1978: 35). One can, of course, speculate that had Hayek written on the topic intended for him, he would have presented a variation on 'Notes on the Evolution of Systems of Rules of Conduct', which he had only recently written and is the essay in which Hayek focused most explicitly on the importance of higher-level emergent properties (as part of his account of group selection and cultural evolution) (Gaus 2006, Lewis 2015a). But it would have been fascinating to see how Hayek might have developed that work, and to learn how his fellow conferees would have responded to his paper in the discussion that followed, given that—as already noted—there were present at the symposium several scholars who had carried out pioneering work on hierarchical levels of organisation and emergent properties in biology from the 1920s onwards.

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